OPERATING SUMMARY

1972

WATERLOO

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MINISTRY OF THE
ENVIRONMENT

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Ontario

Ministry of the
Environment

135 St. Clair Avenue West
Toronto 195, Ontario

We are pleased to present you with the 1972 operating summary for the water pollution control plant serving your community.

This summary contains data on the performance of the plant as well as relevant financial information. Of particular interest is the review of the year's activities in which significant items of these data are discussed in some detail by the operations engineer and his staff who, by their day-to-day involvement with the operation, are thoroughly familiar with the plant.

We appreciate your continuing interest in protecting the environment through the efficient operation of this wastewater treatment facility.

D.S. Caverly,
Assistant Deputy Minister.

D.A. McTavish, P. Eng.,
Director,
Project Operations Branch.

MINISTRY OF THE ENVIRONMENT

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135 St. Clair Avenue West
Toronto 195

WATERLOO

WATER POLLUTION CONTROL PLANT

operated for

THE CITY OF WATERLOO

by the

MINISTRY OF THE ENVIRONMENT

1972 ANNUAL OPERATING SUMMARY

CONTENTS

Title Page 1

Flow Diagram 4

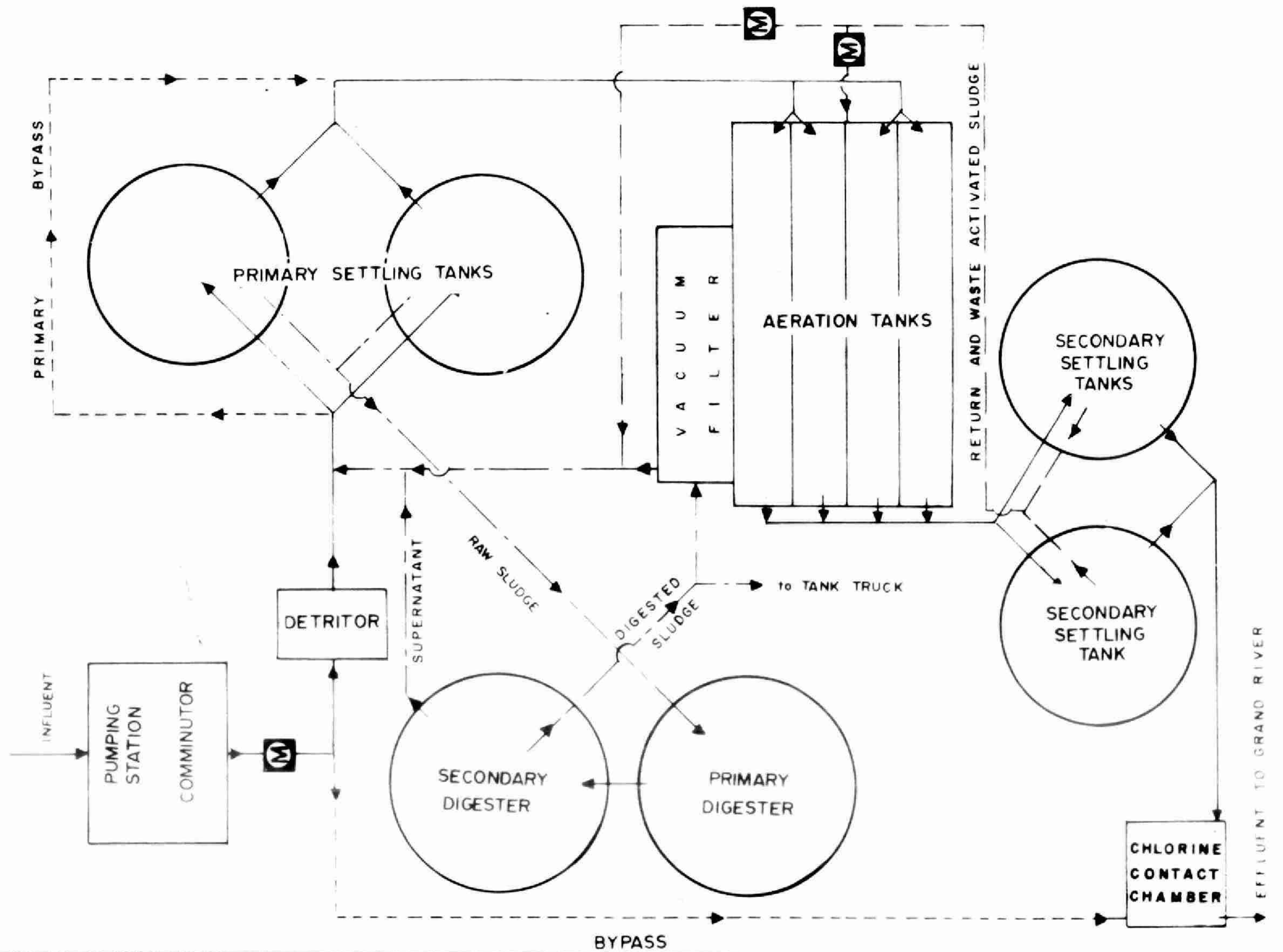
Design Data 5

'72 Review 6

Project Costs 9

Process Data 13

WATERLOO
WATER POLLUTION CONTROL PLANT



DESIGN DATA

PROJECT NOS.	2-0022-58 2-0203-66
DESIGN FLOW	6.0 mgd*
DESIGN POPULATION	30,000
BOD - Raw Sewage	300 mg/l
- Removal	90%
SS - Raw Sewage	270 mg/l
- Removal	90%

PRIMARY TREATMENT

Comminution

One Worthington

Sewage Lift Station

Type: Canada Pump
Size: Two 2900 gpm @ 32' tdh (el)
One 5000 gpm @ 32' tdh (diesel)

Grit Removal

Type: Dorr Detritor
Size: Two 14' x 14' x 1.6' (3.900 gal)
Retention: 0.94 min

Primary Sedimentation

Type: Dorr
Size: Two 75' dia x 13' swd
Ret (0.772 mil gal)
Loading: Surface, 680 gal/ft
Weir, 12,700 gal/t
Retention: 3.09 hours
Loading: Surface, 680 gal/ft^2/day
Weir, 12,700 gal/ft/day

SECONDARY TREATMENT

Aeration Tanks

Type: Diffused air, single-pass with turbine aerators
Size: Four 134' x 32½' x 15½' (1.68 m
Ret (1.68 mil gal)
Retention: 6.7 hours

Diffusers

(a) Spargers (66/tank)
(b) "Lightnin" Turbine (3/tank)

Air Supply

Type: Sutorbilt
Size: Two 3,750 cfm

Secondary Sedimentation

Type: Dorr
Size: Two 65' dia x 10' swd
(0.458 mil gal)
Retention: 1.8 hours
Loading: Surface, 905 gal/ft^2/day
Weir, 14,650 gal/ft/day

CHLORINATION

Type: BIF
Size: One 400 lb/day

OUTFALL

- to Grand River

SLUDGE HANDLING

Digestion System - Two-stage

Primary - fixed cover
Type: Dorr draft tubes (3)
Size: One 80' x 21½' swd
(124,500 cu ft or 0.776 mil gal)
Loading: 3.5 lb/cu ft/mo

Secondary -
Size: One 80' dia x 20' swd
(117,000 cu ft or 0.73 mil gal)
Total Loading: 1.8 lb/cu ft/mo

Vacuum Filter

Type: Komline-Sanderson
Size: One 300 sq ft

* Secondary clarifier 4.0 mgd design rate

'72 Review

GENERAL

In 1972 the plant treated a total of 2,060 million gallons of sewage at a total cost of $172,228.89. The operating cost per million gallons was $83.70 and the cost per pound of BOD removed was 4.1 cents while the cost per pound of suspended solids removed was 3.9 cents.

The secondary clarification units do not possess the capacity to efficiently treat peak flows. The hydraulic overload causes the sludge blanket to rise and overflow the secondary clarifier weirs, resulting in a very poor effluent. This deficiency resulted in the planning and construction of an additional secondary clarifier at the plant. The secondary clarifier will be constructed and ready for operation by the fall of 1973.

During the year, there have been considerable problems with the presence of oil in the aerator motors. The main problem is that oil is escaping through the oil seal from the reduction units into the motors. The manufacturer is trying to solve these problems by repairing and/or replacing the motor seals. Fortunately, the plant process has not been adversely affected by these problems.

PLANT FLOWS AND CHLORINATION

The average daily flow of 5.6 million gallons is an increase of 12 percent over the 1971 average of 5.0 million gallons per day. The daily design flow was exceeded 30 percent of the time.

An average chlorine dosage rate of 3.9 mg/l was necessary to maintain an average chlorine residual of 0.5 mg/l in the final effluent.

PLANT EFFICIENCY

The raw sewage BOD averaged 230 mg/l with the design raw sewage BOD concentration of 300 mg/l being exceeded 15 percent of the time.

The raw sewage suspended solids averaged 243 mg/l with the design raw sewage suspended solids concentration of 270 mg/l being exceeded approximately 40 percent of the time.

Average BOD and suspended solids in the effluent were 21 and 25 mg/l for a reduction of 91 and 90 percent in BOD and suspended solids respectively. In both cases the average BOD and suspended solids in the effluent is an increase of 3 mg/l from 1971, with the Ministry of the Environment objectives of 15 mg/l for BOD and suspended solids being exceeded 60 and 70 percent of the time. The increase in BOD and suspended solids in the effluent is due to the high hydraulic loading of the plant.

PHOSPHORUS

Laboratory jar tests on various chemicals were conducted at the plant in order to determine the most efficient and economical chemical to be used in a pilot study at the plant which would result in the removal of phosphorus to a level of 1 mg/l by the beginning of 1974.

SLUDGE DIGESTION

A total of 86.8 million gallons of sludge was pumped to the primary digesters. The raw sludge averaged 4.8 percent total solids, of which 64 percent was volatile matter.

Digested sludge from the secondary digesters averaged 2.7 percent total solids of which 53 percent was volatile matter with the average reduction of volatile matter being 35 percent.

A total of 54, 687 cubic yards of sludge was hauled during the year.

AERATION

The average MLSS concentration of 2860 mg/l and the F/M ratio of 0.23 are within the accepted limits of good aeration tank operation.

CONCLUSIONS AND RECOMMENDATIONS

The expansion of the final clarification system, in operation by the fall of 1973, should result in an improved effluent which should meet the Ministry's objectives most of the time.

Considering the high organic and hydraulic loading and the under-designed secondary clarification units, the plant maintained a high degree of efficiency producing a fairly good effluent during the year.

Expansion of the plant is being considered as the consulting engineer has prepared a report on the expansion of the plant.

PROJECT COSTS

2-0022-58 - Stage I

NET CAPITAL COST	$728, 675. 93
DEDUCT - Portion financed by	
Long Term Debt to MOE	$728, 675. 93
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1972	$427, 823. 70
Net Operating	$172, 541. 15
Debt Retirement	12, 499. 00
Reserve	3, 148. 46
Interest Charged	40, 863. 39
TOTAL	$229, 052. 00

RESERVE ACCOUNT

Balance @ January 1, 1972	$ 50, 529. 19
Deposited by Municipality	3, 148. 46
Interest Earned	3, 319. 16
	$ 56, 996. 81
Less Expenditures	-
Balance @ December 31, 1972	$ 56, 996. 81

PROJECT COSTS

2-0022-58 - Stage II

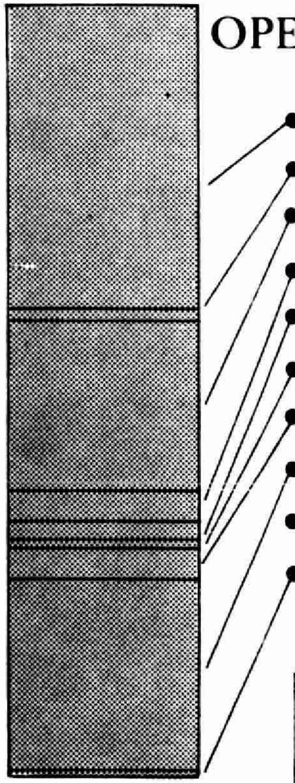
NET CAPITAL COST	$13, 226. 41
DEDUCT - Portion financed by	
Long Term Debt to MOE	$13, 226. 41
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1972	$ 6, 910. 89
Net Operating	$ -
Debt Retirement	262. 00
Reserve	-
Interest Charged	741. 72
TOTAL	$ 1, 003. 72

RESERVE ACCOUNT

Balance @ January 1, 1972	$ 1, 646. 64
Deposited by Municipality	-
Interest Earned	107. 99
	$ 1, 743. 63
Less Expenditures	-
Balance @ December 31, 1972	$ 1, 743. 63

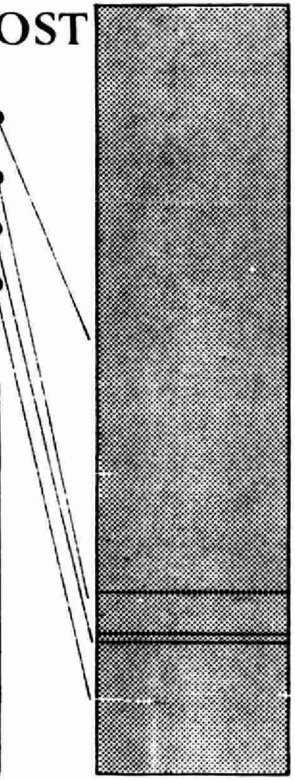
1972 COSTS

OPERATING COSTS



PAYROLL	39 %
FUEL	1 %
POWER	22 %
CHEMICALS	4 %
GENERAL SUPPLIES	2 %
EQUIPMENT	1 %
REPAIRS & MAINTENANCE	3 %
SUNDRY	28 %
WATER	NIL %
TRAVEL	<1 %

TOTAL ANNUAL COST



NET OPERATING	75 %
DEBT RETIREMENT	6 %
RESERVE	1 %
INTEREST	18 %

YEARLY OPERATING COSTS

YEAR	SEWAGE TREATED in million gallons	TOTAL OPERATING COSTS	TREATMENT COSTS $ per million gal	TREATMENT COSTS ¢ per lb BOD
1968	1533.7**	138,403.88	90.24	3 cents
1969	180.1	152,659.35	84.34	3 cents
1970	1784.0	166,390.69	93.27	3 cents
1971	1903.	176,260.41	92.60	4 cents
1972	2058.	172,222.89	84.00	4 cents

MONTHLY OPERATING COSTS

MONTH	TOTAL EXPENDITURE	REGULAR PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICALS	GENERAL SUPPLIES	EQUIPMENT	REPAIRS and MAINTENANCE	SUNDRY*	WATER	TRAVEL
JAN	4825.59	4795.25					.37			29.97		
FEB	15493.97	4798.71		240.30	3603.10	2464.00	208.54		360.61	3773.55		45.16
MAR	11809.34	4707.75	73.29		3521.39		211.97	81.91	183.25	3029.78		
APR	12930.68	4760.10	440.40	144.34	3450.34		502.83		191.18	3385.54		55.95
MAY	13485.59	5044.81	640.93	109.53	3773.62	188.64	116.58	165.97	322.44	3056.68		66.39
JUNE	22919.13	7365.06	639.56	273.86	3210.56	824.60	202.03	706.30	550.70	8989.96		156.50
JULY	10831.32	125.72		104.42	328.516	824.60	76.88	850.50	835.91	4625.07		103.06
AUG	9024.75	4833.02	587.17		2997.41	77.44	68.53	77.37	362.37	21.44		
SEPT	15755.12	5300.69	582.12		2986.75		201.65		487.82	6124.47		71.62
OCT	12616.23	4768.38	475.18	230.50	2919.39		176.54	73.69	125.00	3802.22		45.33
NOV	11290.93	(1348.20)			4471.65		1004.94		107.92	7054.62		
DEC	31246.24	17289.12	1018.52	13.06	3299.33	2986.40	754.12	568.53	1226.32	3854.91		235.93
TOTAL	172228.89	62440.41	4457.17	1116.01	37518.70	7365.68	3524.98	2524.27	4753.52	47748.21		779.94

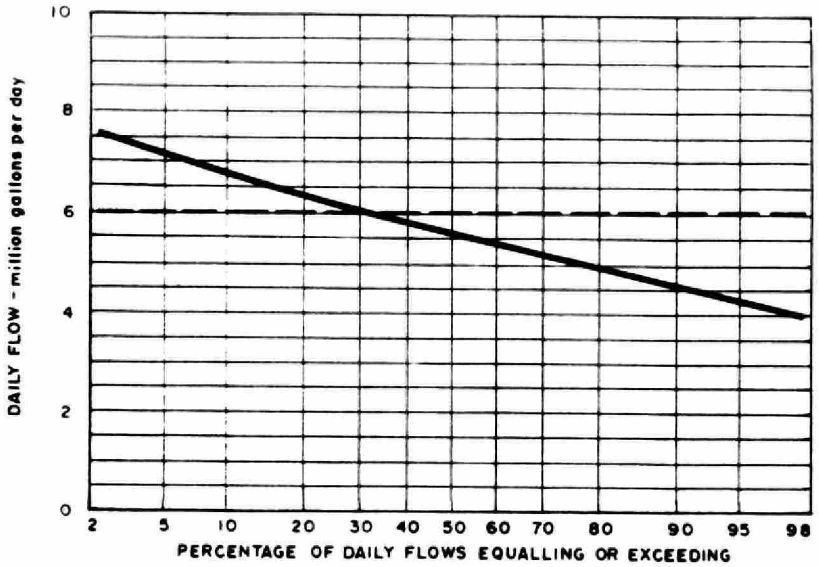
Brackets indicate credit.

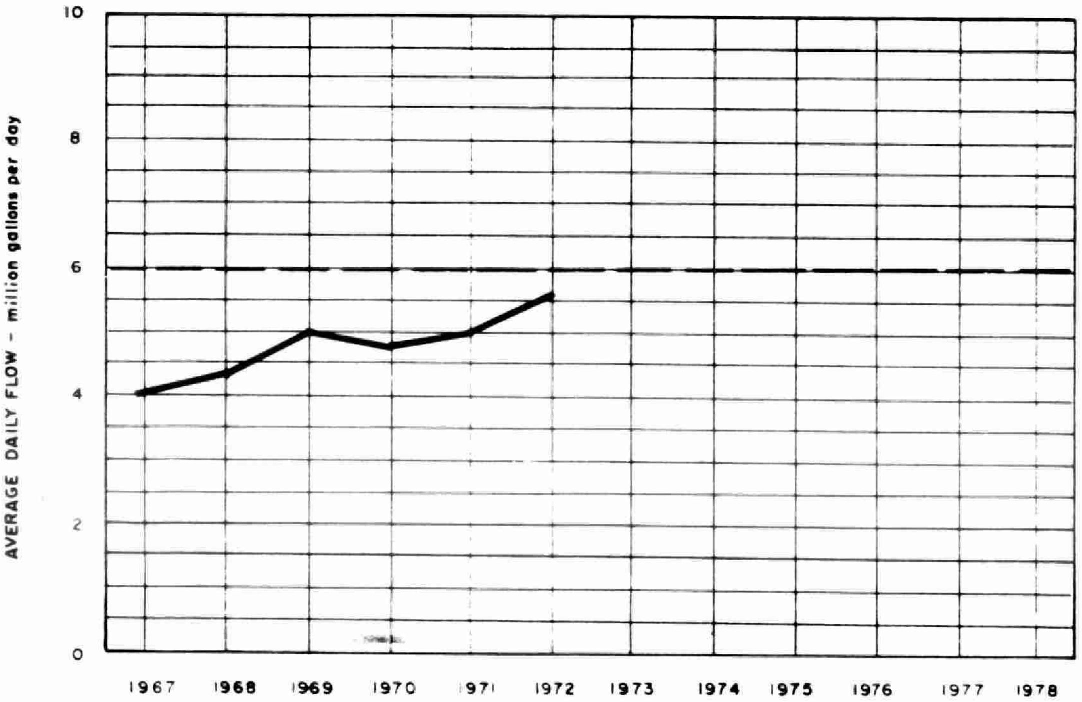
* Sundry includes sludge haulage costs of $38,675.49

PROCESS DATA

PROCESS DATA

FLOWS



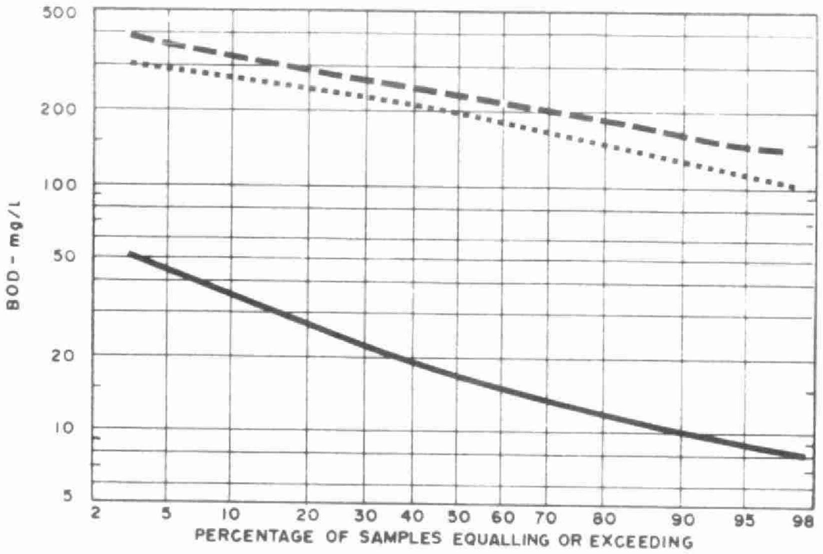


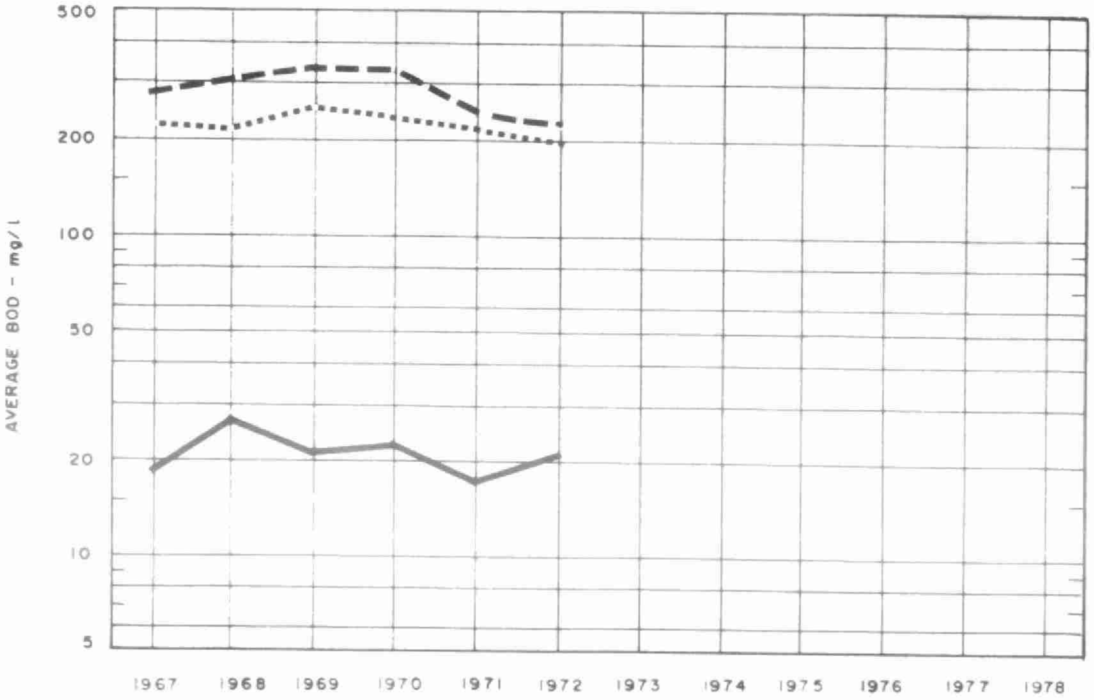
DESIGN CAPACITY - - - - - - - -

PLANT PERFORMANCE

MONTH	FLOWS			BIOCHEMICAL OXYGEN DEMAND				SUSPENDED SOLIDS				PHOSPHORUS	
	TOTAL FLOW million gallons	AVERAGE DAY mil. gal	MAXIMUM DAY mgd	INFLUENT mg/l	EFFLUENT mg/l	REDUCTION %	REDUCTION 10^3 pounds	INFLUENT mg/l	EFFLUENT mg/l	REDUCTION %	REDUCTION 10^3 pounds	INFLUENT mg/l P	EFFLUENT mg/l P
JAN	171	5.5	7.7	206	21	90	320	247	16	94	390	7.5	2.8
FEB	155	5.3	6.7	278	37	87	370	221	40	82	280	6.9	2.3
MAR	192	6.2	7.5	238	20	92	420	258	38	85	420	7.6	1.5
APR	199	6.7	7.9	170	21	89	300	205	24	88	360	4.2	1.0
MAY	169	5.4	6.7	253	13	95	400	285	12	96	460	7.0	1.5
JUNE	166	5.5	7.1	195	16	92	300	288	18	94	450	5.8	
JULY	159	5.1	6.0	260	19	93	380	218	21	90	310	10.0	3.1
AUG	168	5.4	6.7	278	18	94	440	237	28	88	350	8.4	1.2
SEPT	154	5.1	6.6	216	19	91	300	257	28	89	350	8.0	1.4
OCT	170	5.5	7.3	199	21	89	300	254	35	86	370	7.0	3.3
NOV	177	5.9	7.1	261	25	90	420	241	24	90	380	7.5	1.8
DEC	180	5.8	8.2	182	20	89	290	204	22	89	330	5.5	2.6
TOTAL	2060	-	-	-	-	-	4240	-	-	-	4450	-	-
AVG.		5.6	MAXIMUM 8.2	230	21	91	350	243	25	90	370	7.1	2.1
No. of Samples	-	-	-	75	75	-	-	205	204	-	-	12	11

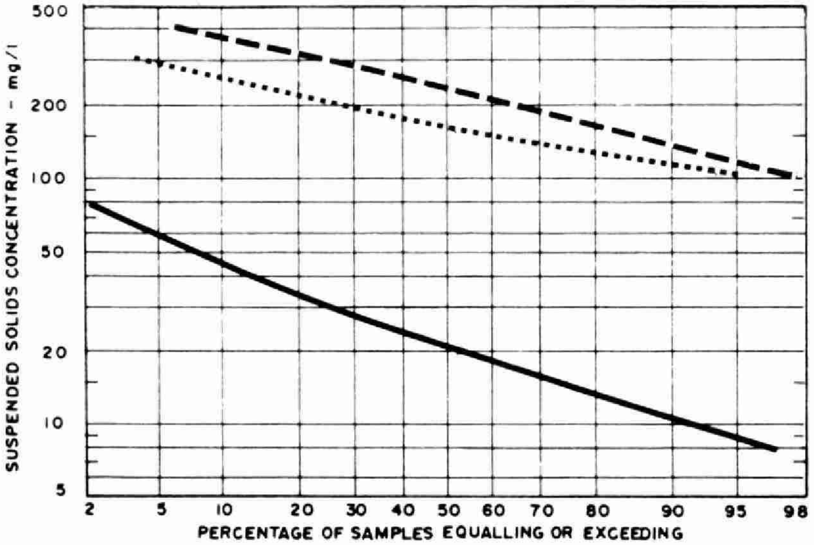
BIOCHEMICAL OXYGEN DEMAND

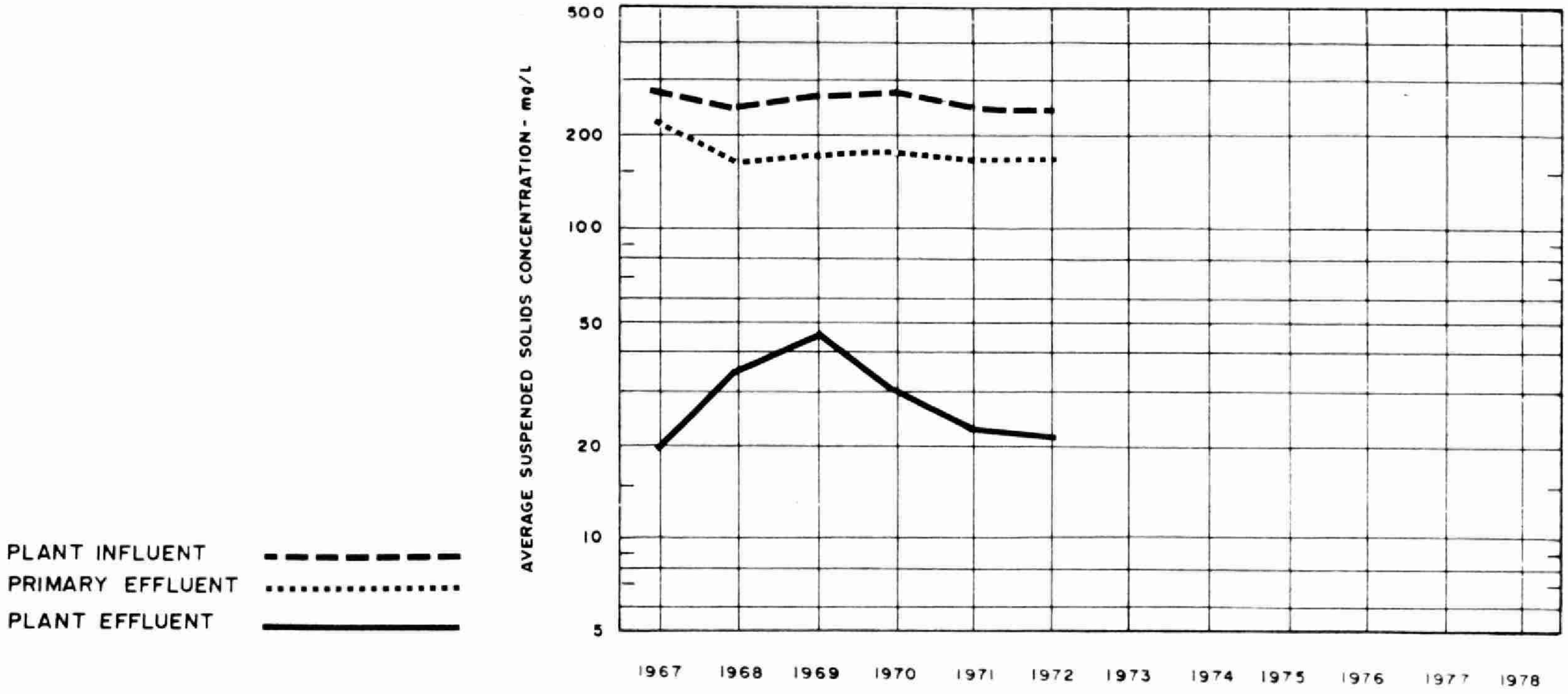




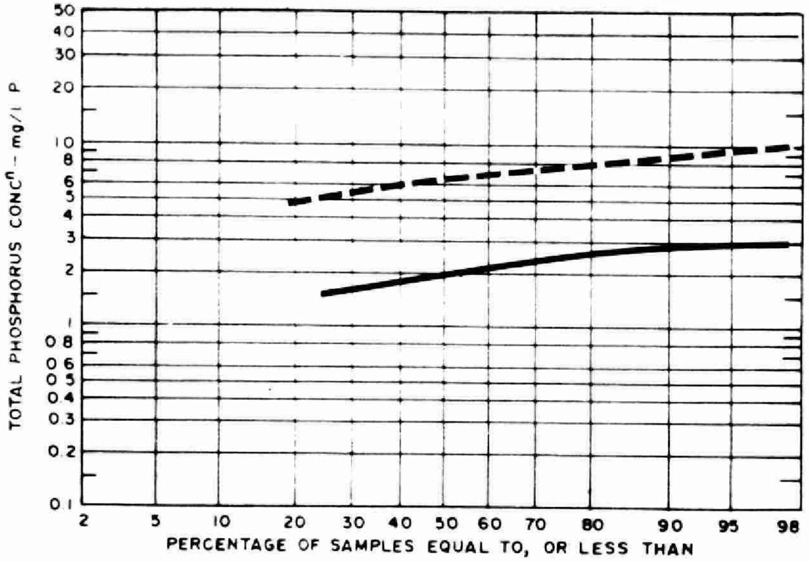
PLANT INFLUENT — — — — —
PRIMARY EFFLUENT ················
PLANT EFFLUENT ————————

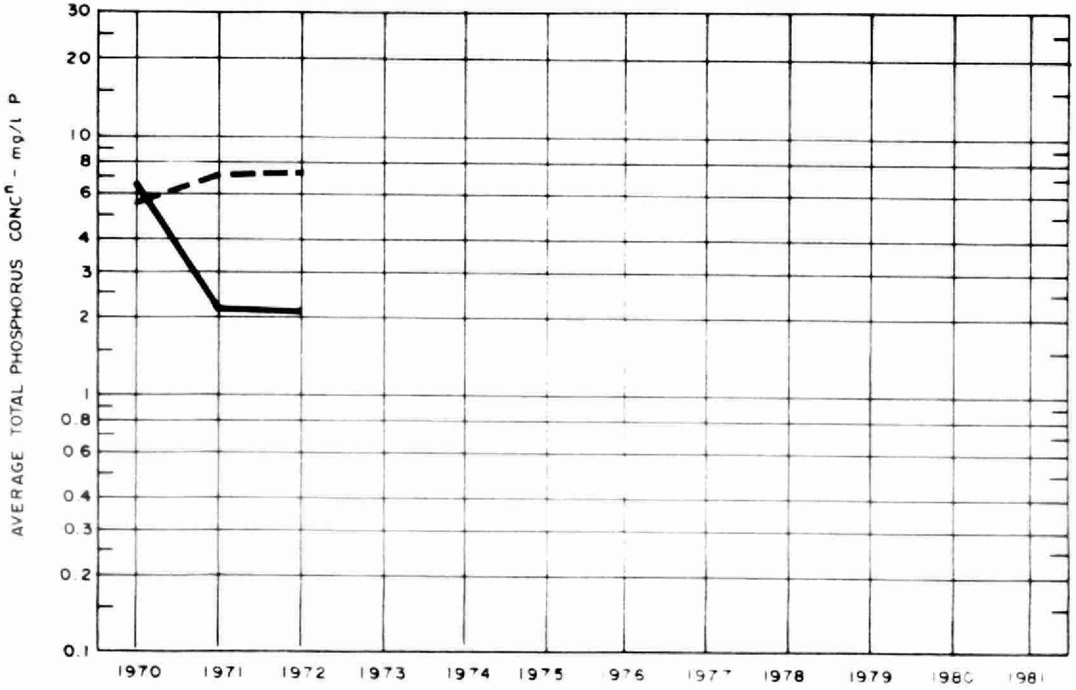
SUSPENDED SOLIDS





PHOSPHORUS

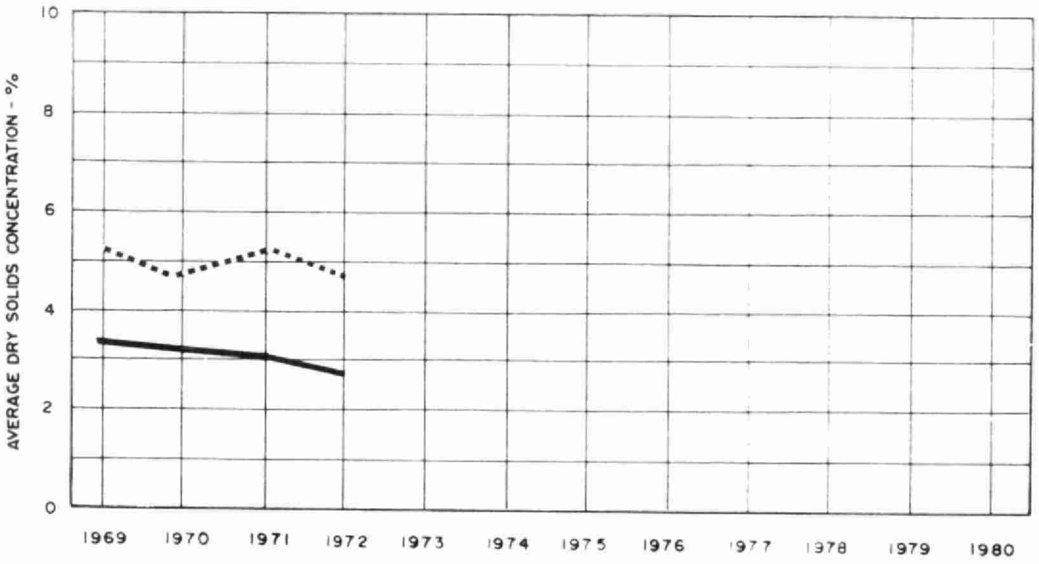


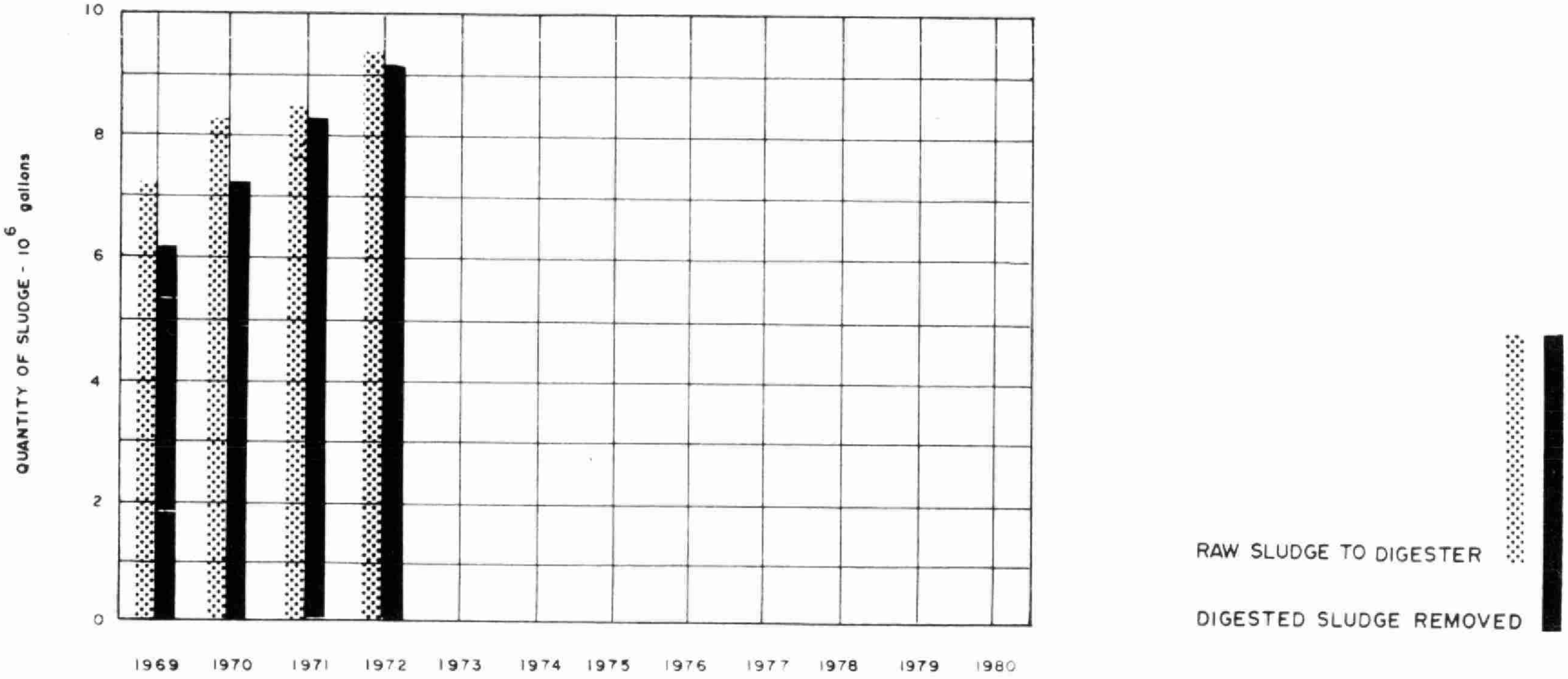


PLANT INFLUENT – – – – – –

PLANT EFFLUENT ————

DIGESTION


AVERAGE DRY SOLIDS CONCENTRATION - %
10
8
6
4
2
0
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
RAW SLUDGE
DIGESTED SLUDGE


QUANTITY OF SLUDGE - 10^6 gallons
10
8
6
4
2
0
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
RAW SLUDGE TO DIGESTER
DIGESTED SLUDGE REMOVED

TREATMENT DATA

	GRIT	CHLORINATION		PRIMARY EFFLUENT		AERATION			SLUDGE DIGESTION and DISPOSAL							
									RAW SLUDGE			DIGESTED SLUDGE			SUPER-NATANT	
MONTH	QUANTITY REMOVED cubic feet	Cl_2 USED 10^3 pounds	AVG DOSE mg/l	BOD mg/l	SUSPENDED SOLIDS mg/l	MLSS CONC mg/l	F/M day^{-1}	AIR $\frac{1000\ ft^3}{lb\ BOD}$	QUANTITY 10^3 gallons	TOTAL SOLIDS %	VOL. SOLIDS %	QUANTITY 10^3 gallons	TOTAL SOLIDS %	VOL. SOLIDS %	T. S. %	AMOUNT HAULED cubic yards
JAN	200	6.3	3.7	169	137	2800	.20	.6	800	4.5	67	840	2.2	55		4993
FEB	260	6.8	4.4	222	125	2590	.27	.5	610	4.5	68	650	2.8	53		3847
MAR	520	7.9	4.1	170	162	2480	.25	.6	720	4.9	64	750	2.3	54		4436
APR	380	7.7	3.9	157	151	2720	.23	.6	690	5.6	61	620	2.3	56		3699
MAY	270	6.3	3.7	225	161	2760	.26	.5	860	5.6	60	850	2.9	51		5036
JUNE	170	5.4	3.3	175	182	2750	.21	.6	850	4.8	64	980	2.9	51		5797
JULY	170	5.7	3.6	186	137	3020	.19	.7	690	5.1	61	670	2.9	50		3956
AUG	240	5.5	3.3	215	130	3130	.22	.7	610	5.1	62	710	3.0	50	2.4	4205
SEPT	210	5.7	3.7	180	126	2900	.19	.7	860	4.2	63	850	3.3	50		5032
OCT	260	6.1	3.6	190	185	2990	.21	.6	800	4.3	66	790	3.1	56	.4	4665
NOV	160	6.8	3.9	265	285	3150	.31	.4	980	4.1	66	830	2.4	56	.4	4943
DEC	210	9.3	5.2	160	150	2970	.19	.7	850	5.0	64	690	2.5	55	.6	4078
TOTAL	3050	79.5	–	–	–	–	–	–	9320	–	–	9230	–	–	–	54687
AVG.	1.5 cu. ft/mil gal	6.6	3.9	198	165	2860	.23	.6	780	4.8	64	770	2.7	53	1.0	4557

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